

At the initial stage of this sputtering step, vertically incident ions such as  $H^{+}$ ,  $Ar^{+}$  and  $Ti^{+}$  accelerated by the substrate bias collide with the native oxide film 4. Of these ions,  $H^{+}$  and  $Ti^{+}$  react with the native oxide film 4, to remove the native oxide film 4 by chemical sputtering in which  $H_2O$  and  $TiO_2$  are generated. Also,  $Ar^{+}$  removes the native oxide film 4 by the known physical sputtering (FIG. 1B).

differential sheath potential collide with the native oxide film 4. Of these ions,  $H_{sup.+}$  and  $Ti_{sup.+}$  react with the native oxide film 4, to remove the native oxide film 4 by chemical sputtering in which  $H_{sub.2}O$  and  $TiO_{sub.2}$  are generated. Also,  $Ar_{sup.+}$  removes the native oxide film 4 such as  $Al_{sub.2}O_{sub.3}$  or  $TiON$  by the known physical sputtering (FIG. 2B).

Detailed Description Text - DETX (80):

The native oxide film 4 is formed on the surface of the impurity diffusion layer 22, and at the initial stage of the plasma CVD, vertically incident ions such as  $H_{sup.+}$ ,  $Ar_{sup.+}$  and  $Ti_{sup.+}$  accelerated by the differential sheath potential collide with the native oxide film 4. of these ions,  $H_{sup.+}$  and  $Ti_{sup.+}$  react with the native oxide film 4, to remove the native oxide film 4 by chemical sputtering in which  $H_{sub.2}O$  and  $TiO_{sub.2}$  are generated. Also,  $Ar_{sup.+}$  removes the native oxide film 4 such as  $Al_{sub.2}O_{sub.3}$  and  $TiON$  by the known physical sputtering (FIG. 3B).

Detailed Description Text - DETX (105):

By introducing Ar gas from the gas inlet (not shown), and applying a DC voltage for sputtering to a Ti target, Ti particles are generated. At this time, a RF power is supplied from the ICP power supply to the ICP coil 53, to ionize the Ti particles thus sputtered by collision with Ar ions and electrons in the ICP plasma. Then, the Ti ions thus generated are made incident on the substrate 41 to be processed in the direction substantially perpendicular to the substrate 41 by applying a substrate bias to the susceptor 42.

Detailed Description Text - DETX (111):

US-PAT-NO: 6040021

DOCUMENT-IDENTIFIER: US 6040021 A

TITLE: Plasma CVD process for metal films  
and metal nitride films

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Detailed Description Text - DETX (36):

Referring to FIGS. 1A to 1C, which are schematic sectional views showing steps of the plasma CVD process of the present invention, the native oxide film 4 is, as described above, formed by re-oxidation on the bottom portion of the contact hole 3 (FIG. 1A). At the initial stage of the plasma CVD, vertically incident ions such as H.sup.+, Ar.sup.+ and Ti.sup.+ accelerated by the differential sheath potential collide with the native oxide film 4. Of these ions, H.sup.+ and Ti.sup.+ react with the native oxide film 4, to remove the native oxide film 4 by chemical sputtering in which H.sub.2 O and TiO.sub.2 are generated. Also, Ar.sup.+ removes the native oxide film 4 by the known physical sputtering (FIG. 1B).

Detailed Description Text - DETX (58):

Referring to FIGS. 2A to 2C, which are schematic sectional views showing steps of the plasma CVD process of the present invention, the native oxide film 4 such as Al.sub.2 O.sub.3 or TiON is, as described above, formed on the bottom portion of the via-hole 3 (FIG. 2A) formed in the substrate to be processed. At the initial stage of the plasma CVD, vertically incident ions such as H.sup.+, Ar.sup.+ and Ti.sup.+ accelerated by the

| L Number | Hits | Search Text  | DB                               | Time stamp          |
|----------|------|--|----------------------------------|---------------------|
| 1        | 2589 | (sputter or sputtering) same (remove or removing) same oxide   | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:44 |
| 2        | 1545 | (sputter or sputtering) same ((remove or removing) with oxide)   | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:55 |
| 3        | 536  | ((sputter or sputtering) same ((remove or removing) with oxide)) and (RF or (radio adj frequency))   | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:44 |
| 4        | 376  | ((sputter or sputtering) same ((remove or removing) with oxide)) and ((sputter or sputtering) same (RF or (radio adj frequency)))  | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:04 |
| 5        | 293  | ((sputter or sputtering) same ((remove or removing) with oxide)) and ((sputter or sputtering) same (RF or (radio adj frequency)))) and (opening or trench or hole or via or recess or aperture)                                | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:44 |
| 6        | 187  | ((sputter or sputtering) same ((remove or removing) with oxide)) and ((sputter or sputtering) same (RF or (radio adj frequency)))) and (opening or trench or hole or via or recess or aperture)) and @ad<20010828              | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:48 |
| 7        | 79   | ((sputter or sputtering) same ((remove or removing) with oxide)) and ((sputter or sputtering) same (RF or (radio adj frequency)))) and (opening or trench or hole or via or recess or aperture)) and @ad<20010828) and organic | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:07 |
| 8        | 521  | (sputter or sputtering) same (remove or removing) same oxide   | EPO; JPO;<br>DERWENT;<br>IBM_TDB | 2004/11/02<br>10:44 |
| 11       | 4094 | 438/637,623,700,710,725,780,798.ccls. and @ad<20010828   | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:54 |
| 14       | 1618 | (438/637,623,700,710,725,780,798.ccls. and @ad<20010828) and (sputter or sputtering)   | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:55 |
| 15       | 1349 | ((438/637,623,700,710,725,780,798.ccls. and @ad<20010828) and (sputter or sputtering) ) and oxide  | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:55 |
| 16       | 2757 | 257/642,774,758.ccls. and @ad<20010828   | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:55 |
| 17       | 1094 | (257/642,774,758.ccls. and @ad<20010828) and (sputter or sputtering)   | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:55 |
| 18       | 870  | ((257/642,774,758.ccls. and @ad<20010828) and (sputter or sputtering) ) and oxide  | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:55 |
| 19       | 24   | ((257/642,774,758.ccls. and @ad<20010828) and (sputter or sputtering) ) and oxide) and (sputter or sputtering) same ((remove or removing) with oxide)  | USPAT;<br>US-PGPUB               | 2004/11/02<br>10:55 |